

Open Smart Energy Gateway



Technology Update and Request for Partners May 19, 2014

Sponsored by LBNL through the CEC PIER Program

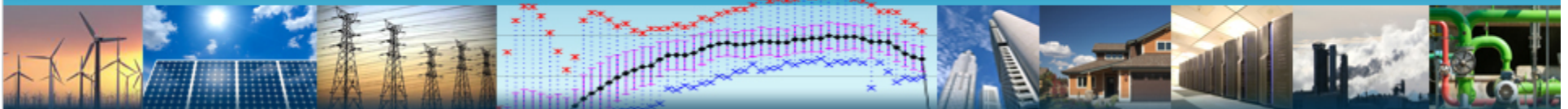
Janie Page, Chuck McParland and Mary Ann Piette



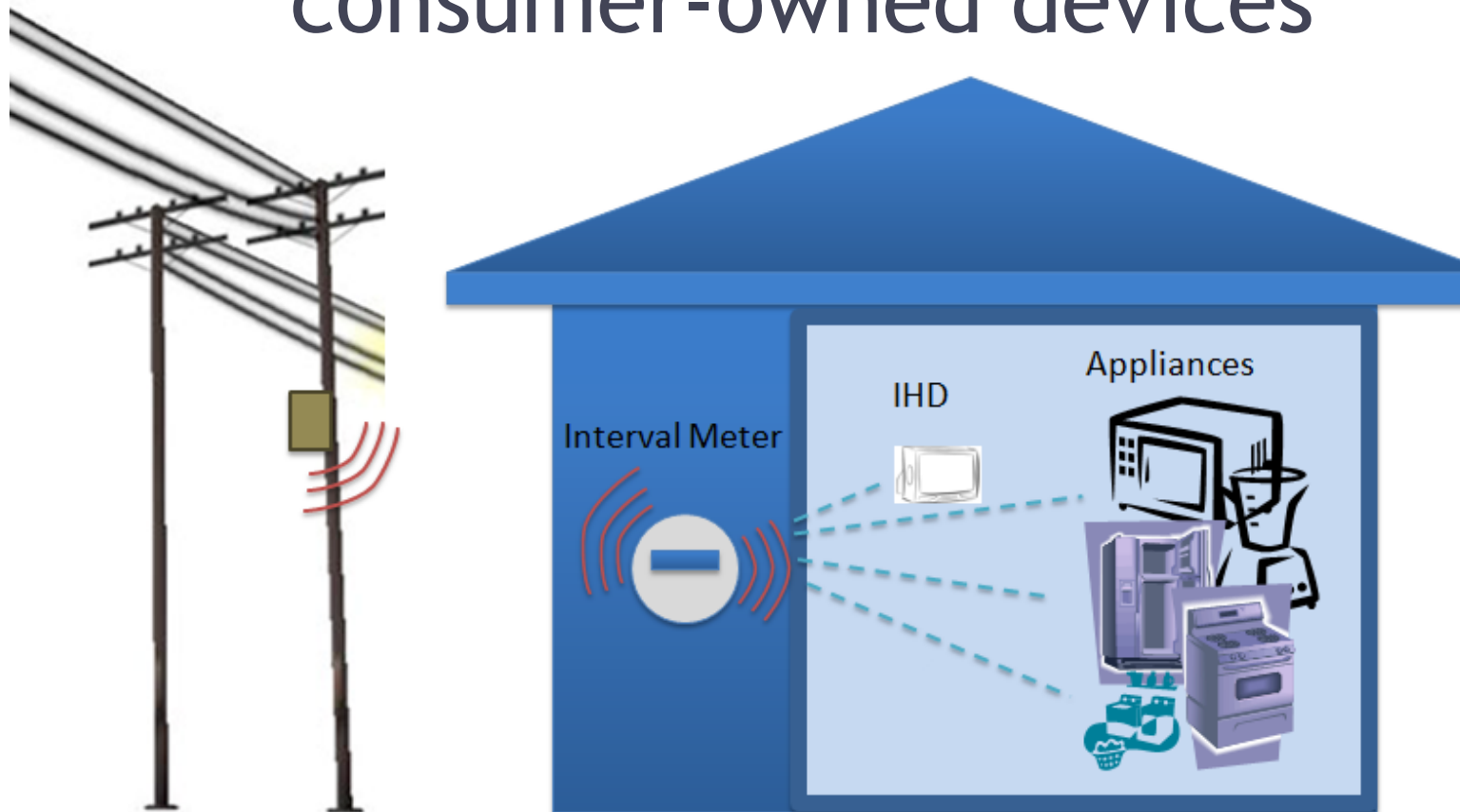
Presentation Outline

- Background
- Overview and Objective of OpenSEG
- Plans to test OpenSEG
- IOU involvement
- Moving OpenSEG to the Open Market

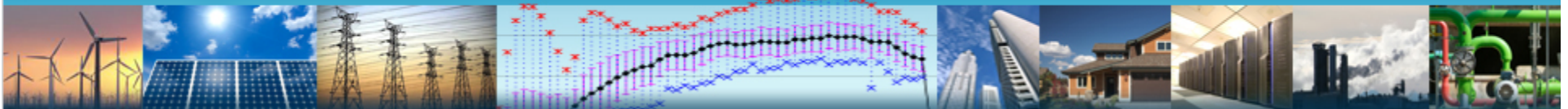
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Earlier “meter-centric” HAN architecture: Interval meter controls consumer-owned devices



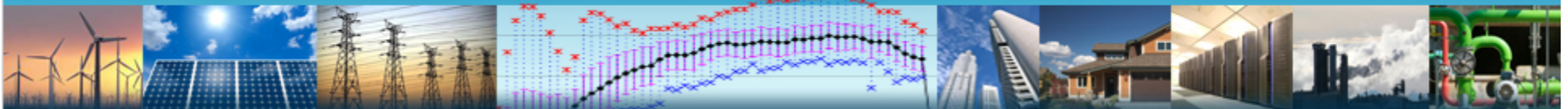
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Background

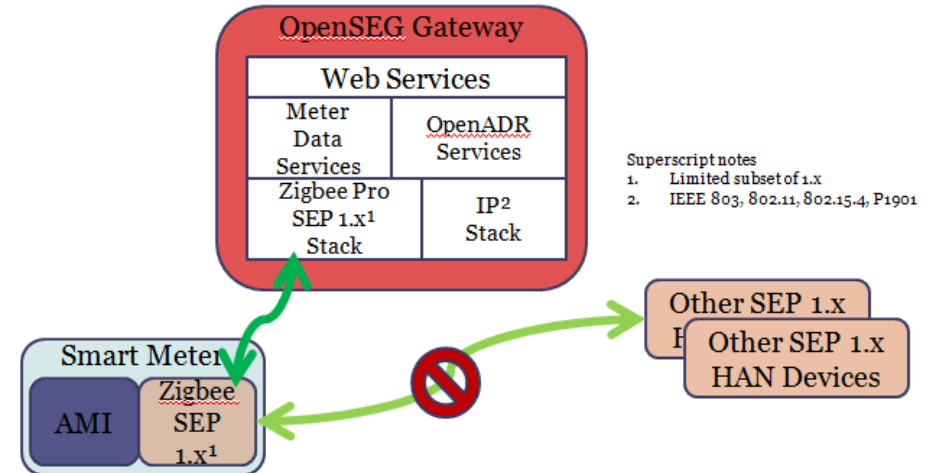
- **Value Concept** - identify how to securely provide smart meter data to consumer applications or aggregator platforms - push data to other applications
- **Method** - recognizing security concerns associated with Zigbee communications, use an Open Smart Energy Gateway to translate SEP 1.x from sole smart meter connection to IP or other non-utility protocol

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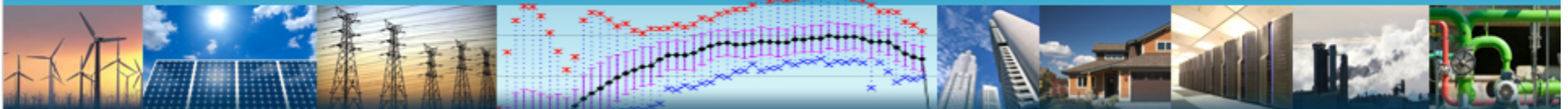


Background - OpenSEG Architecture

- Gateway is only HAN device that pairs to Smart Meter
- Communicates over user supplied communication infrastructure (e.g. WiFi) with other home devices
- Only implements risk free subset of SEP 1.x functions
- Can co-host other functions, such as OpenADR



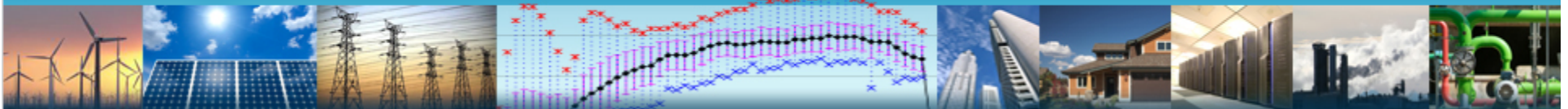
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With less emphasis on security, what problems does OpenSEG address?

- Increasing need for flexibility in demand side resources can be supported by near real time actions and near real time data
- Utility portals only provide electric energy use to consumers in 15 minute increments. Actual meter reads can occur and be locally communicated at rates up to once every 4 seconds.
- Current customer access to this data is mostly web-based, with a 24+ hour latency, through Green Button
- OpenSEG provides secure, reliable consumer access to fine grain consumption data in near real time

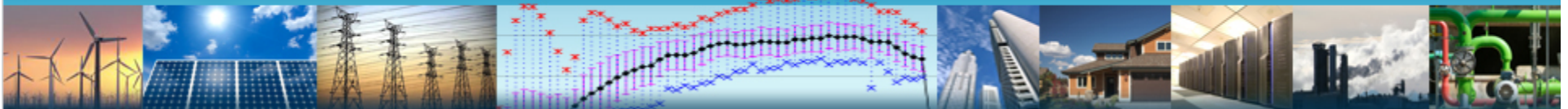
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Present - Key elements of OpenSEG

- Provides real-time feedback to consumers on energy savings efforts
- Architecture responsive to newly uncovered security issues (e.g. Heartbleed)
- Secure capture of data from meter for use by consumer
- Secure 48 hour data cache option (provides data context)
- Data (or derivatives of data) can be stored in secure database

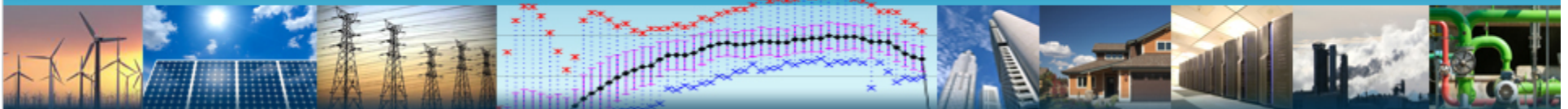
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Potential Secondary OpenSEG Benefits

- **Provides a clear demarcation** between utility control and consumer control
- **Delivers critical timely information** to enable meaningful consumer responses to real time events
- **Addresses consumer concerns** about privacy by securely conveying usage information solely and directly to the consumer
- **Automated M&V** - (example of future application) provides context in which to measure energy consumption changes when linked to baseline models
- **Provides local, consumer driven** smart meter readout that can be compared to back office billing records.

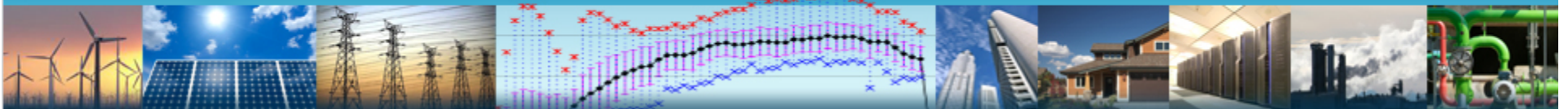
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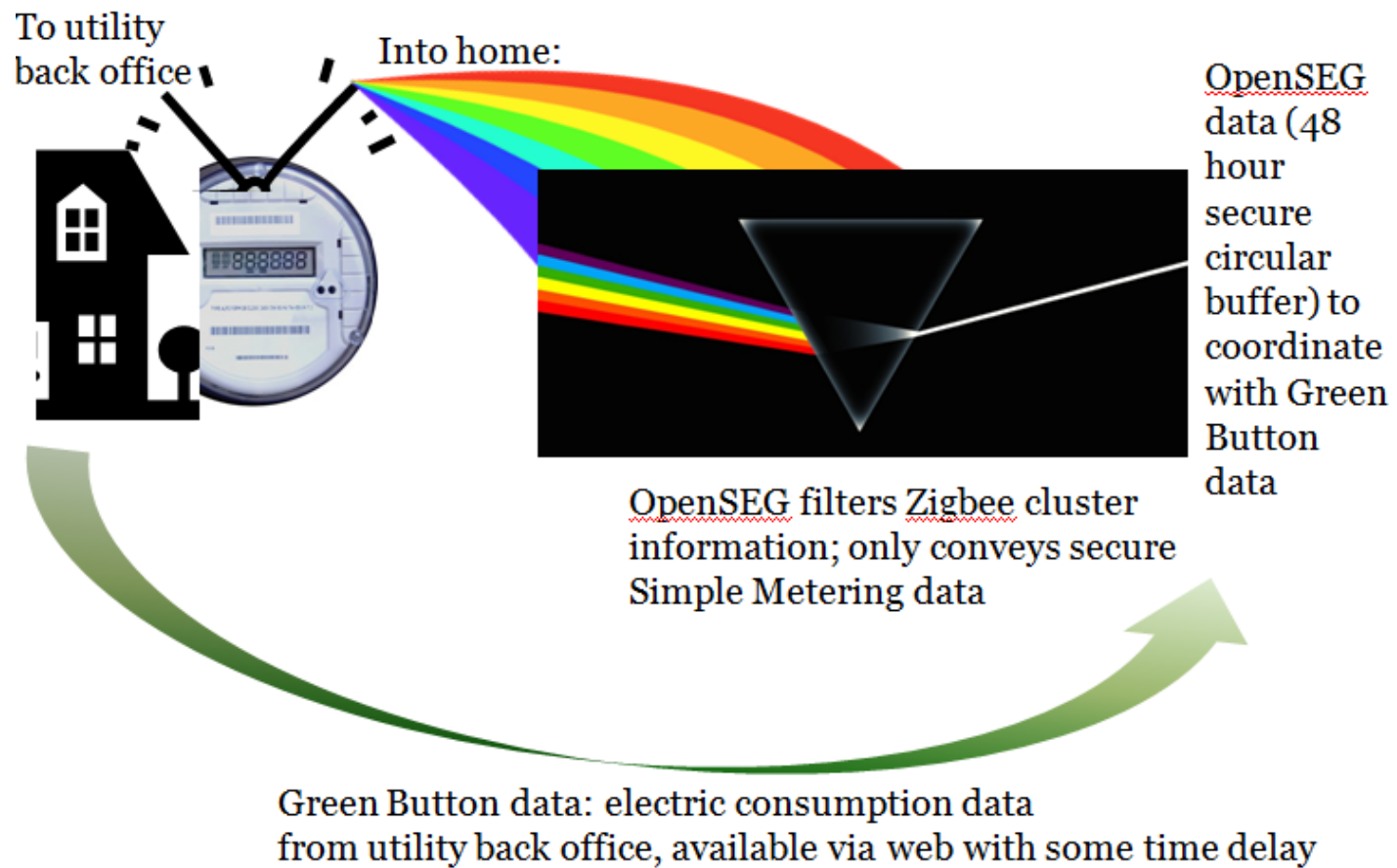
What's inside OpenSEG?

- **Hardware:** OpenSEG is a device that pairs directly and securely with a consumer's interval meter to obtain consumption data
- **Software:** OpenSEG contains code to acquire, store, and display that consumption data as it is acquired from the meter, in a secure way, with useful context

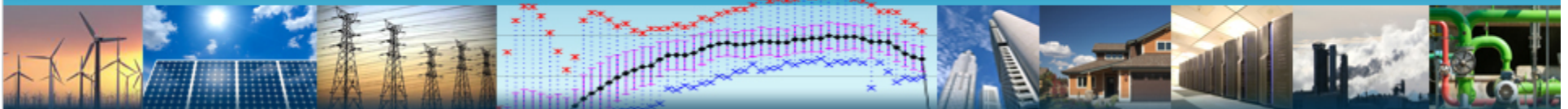
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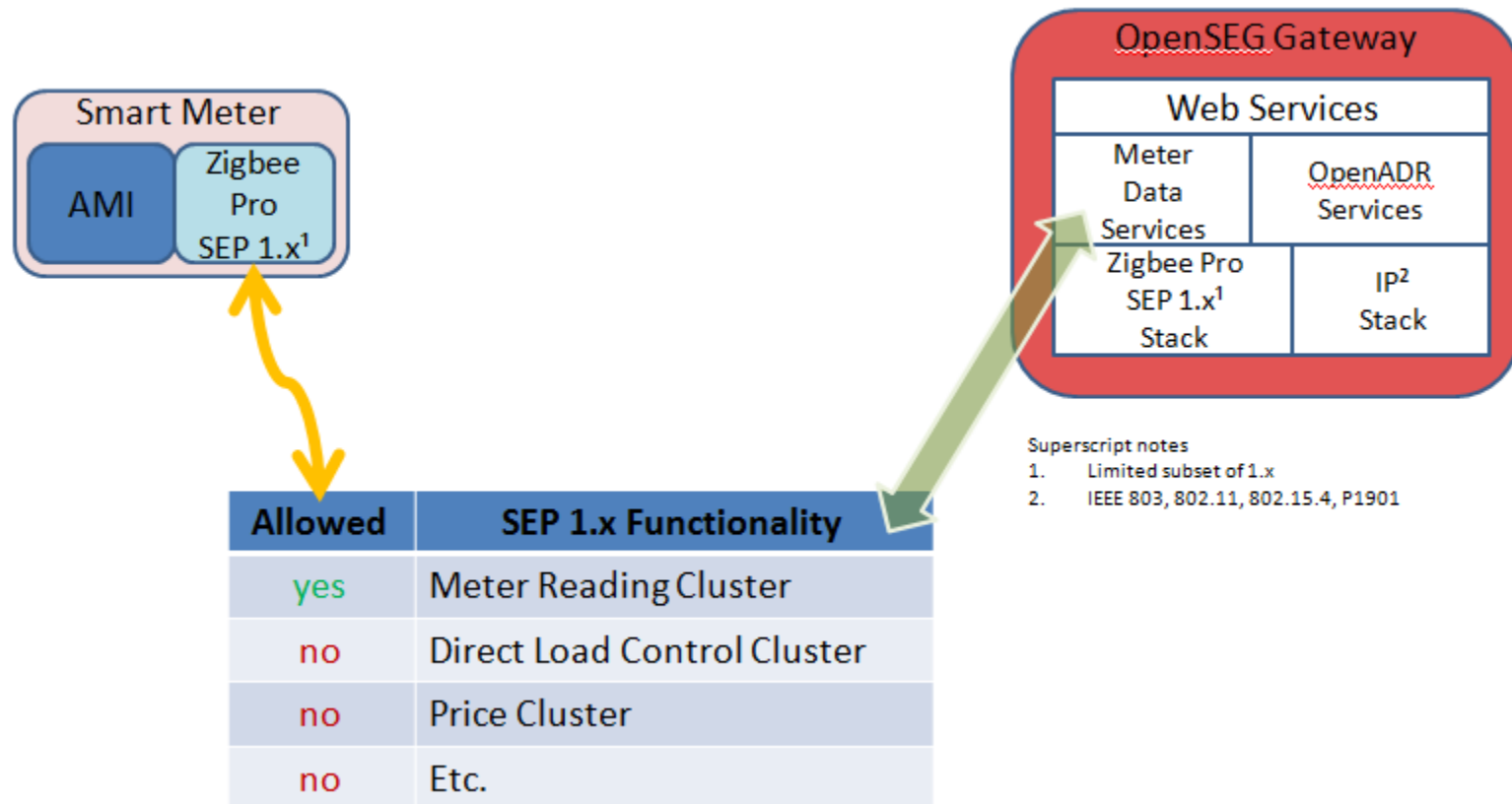
OpenSEG concept



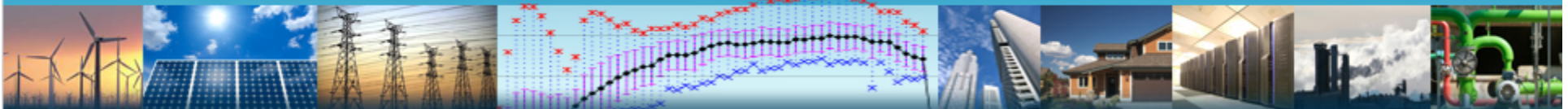
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SEP functions explicitly filtered by OpenSEG gateway firmware

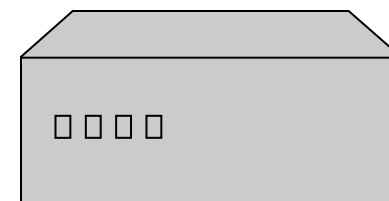


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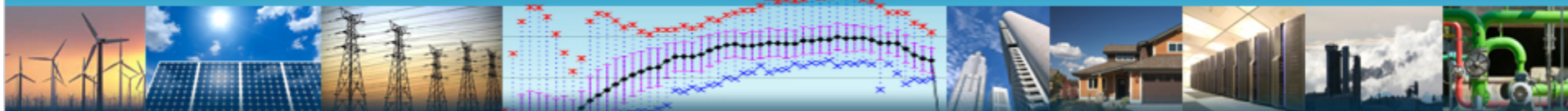


OpenSEG is...

- Data acquisition (dongle)
- Data filter (implemented in small net top box)
- Data cache (secure 48 hour circular buffer) in net top box
- Secure data broadcast (WiFi translation)
- API against which 3rd party applications can be developed



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OpenSEG builds on commercial devices

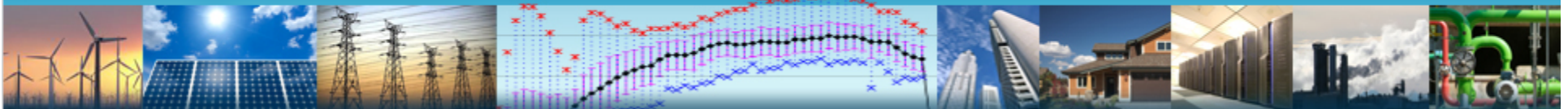
Rainforest dongle only

- Connects to Smart Meter
- Option to use up to 4 second data rate from meter
- Can connect wirelessly to another device to transfer data

OpenSEG

- Connects to Smart Meter
- Option to use up to 4 second data rate from meter
- Can connect wirelessly to another device to transfer data
- Data requests must conform to established format
- Filters for only Simple Metering Cluster data requests
- Secure 48 hour circular data cache
- Provides Green Button format data if requested

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OpenSEG changes the way consumers interact with their meter

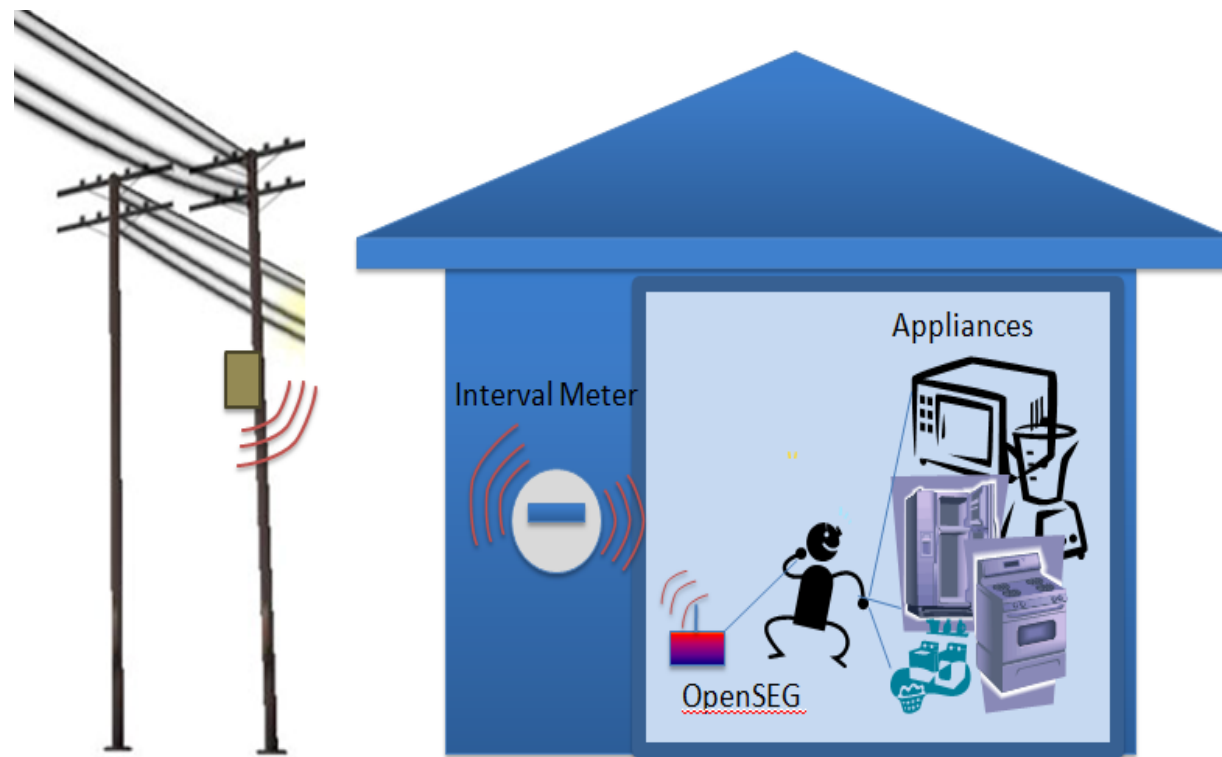
Benefits

- Lowest cost \$/kW telemetry platforms for aggregation
- Secure data acquisition from meter
- Open source
- Near real time
- Standardized software interface

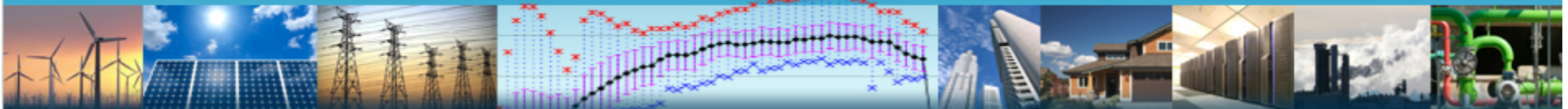
Use Cases

- Aggregation for Ancillary Services
- Automated M&V
- Informed consumption trends
- Potential Load Disaggregation
- Extension to multi-family and larger homes via WiFi network

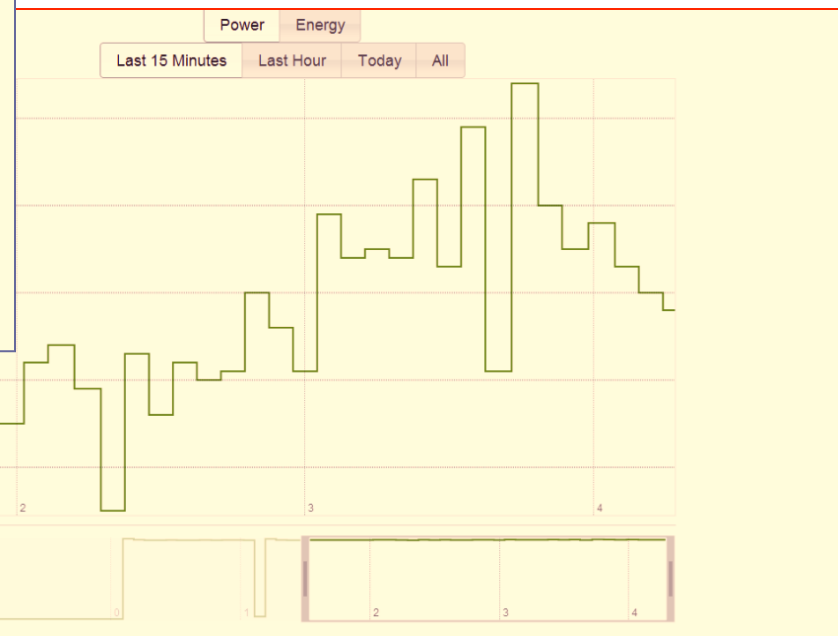
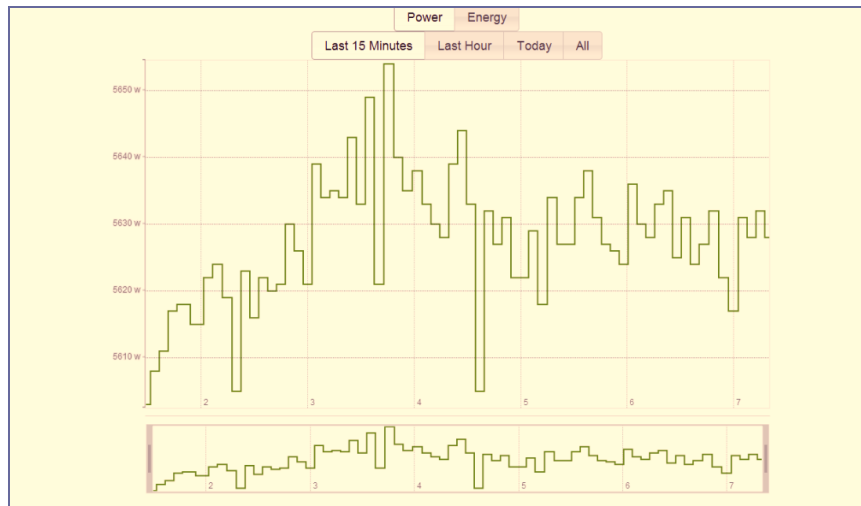
NEW HAN architecture: Consumer controls consumer-owned devices using real time information (control can be automated, too)



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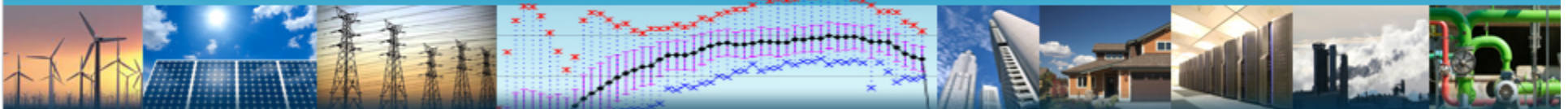


Early tests @ LBNL Demand to Grid Lab



Time scales in seconds →

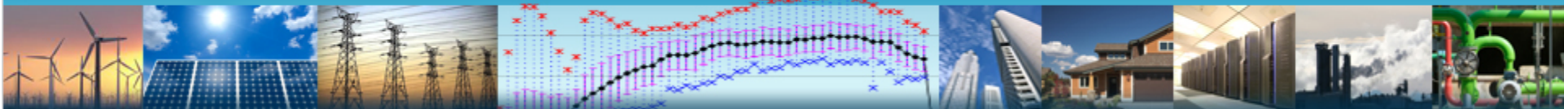
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OpenSEG demonstration goals

- **To promote development** open source software and hardware tools to capture high frequency smart meter kW data using existing low-cost hardware and open source components.
- **To demonstrate** the robustness of the OpenSEG, ease of installation, capability for communications and data capture

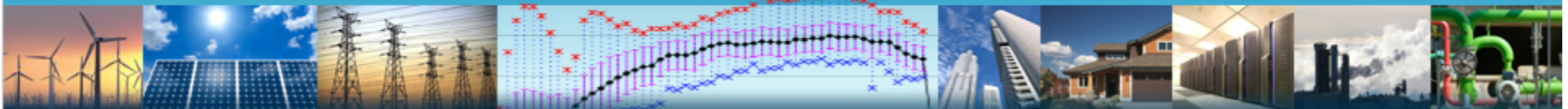
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Selected test buildings

- Next step is to identify buildings where OpenSEG can be deployed for testing (must have internet access, ideally would represent appropriate range of building types and be geographically dispersed)
- Establish appropriate MOU with facility manager
- Perform testing May - October 2014

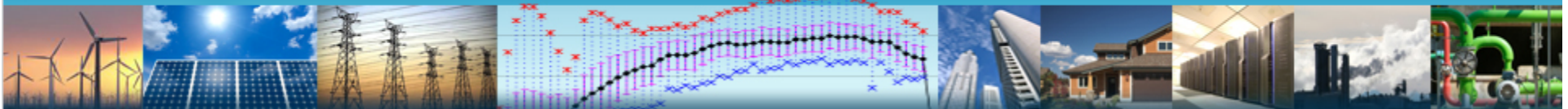
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IOU involvement

- Help us identify 2-3 sites in your territory that might benefit from OpenSEG
- Open the Zigbee radio in the smart meter to allow OpenSEG access to data
- For PG&E and SMUD: SilverSpring Network not bench tested, so may need assistance
- For SCE and SDG&E: We anticipate this could facilitate enhanced demand responses for SONGS mitigation.

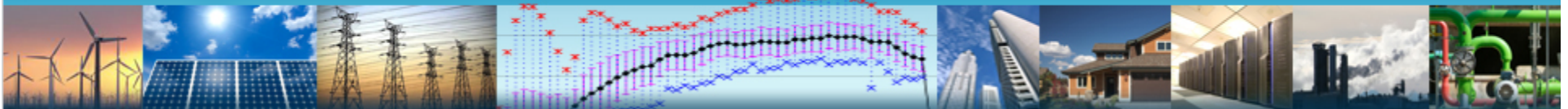
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Tech transfer plans

- Once field tested, demo concept outside lab for commercial development.
- Obtain utility collaboration on features identified during testing –
 - improve grid reliability?
 - improve consumer benefits from smart meters?

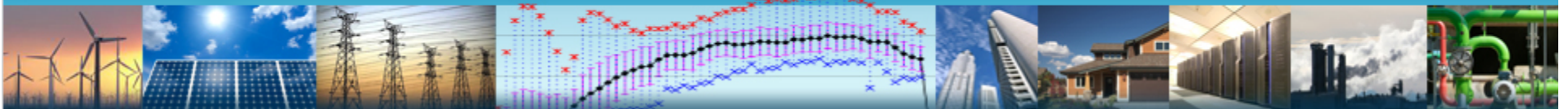
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Thank you for your time



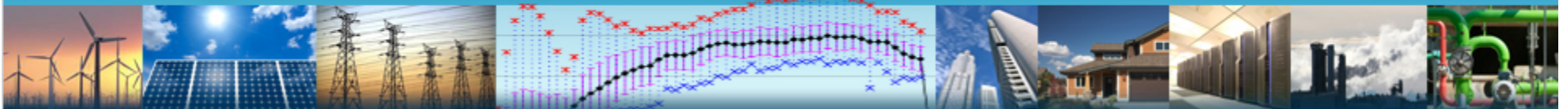
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Extra Slides

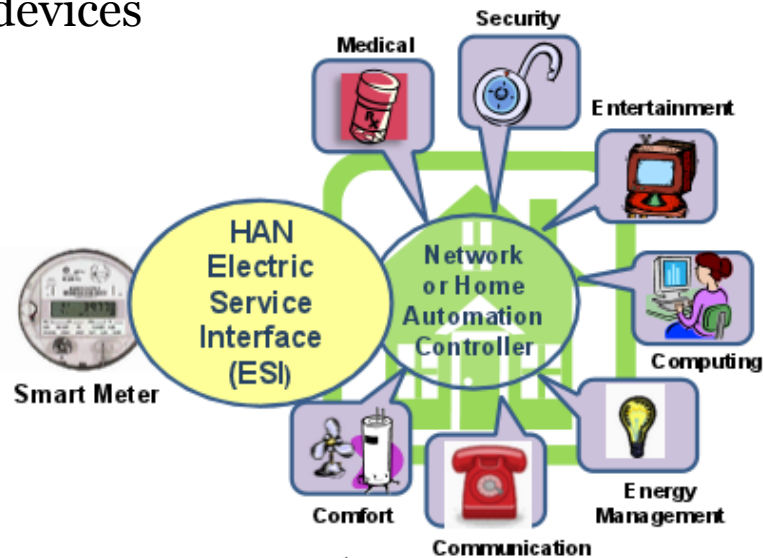
(additional background material)

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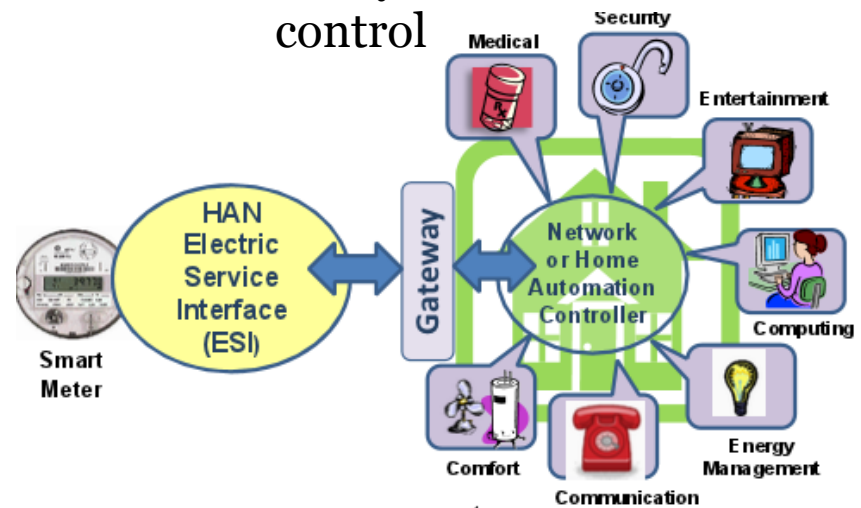


Revised Architecture

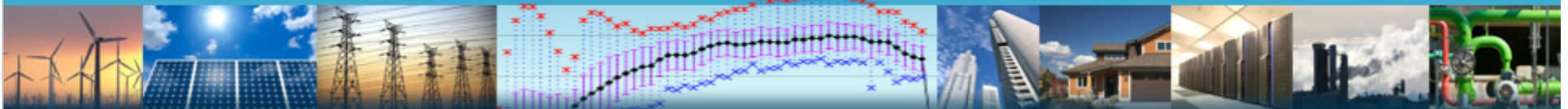
Meter as gateway: direct utility control of home devices



Gateway provides demarcation between utility and consumer control



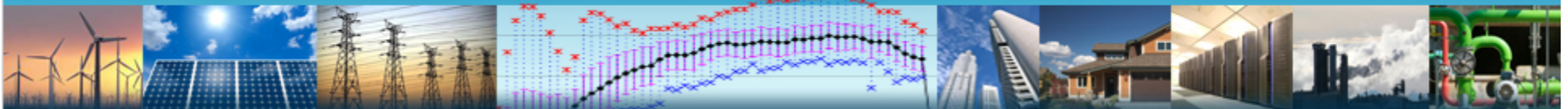
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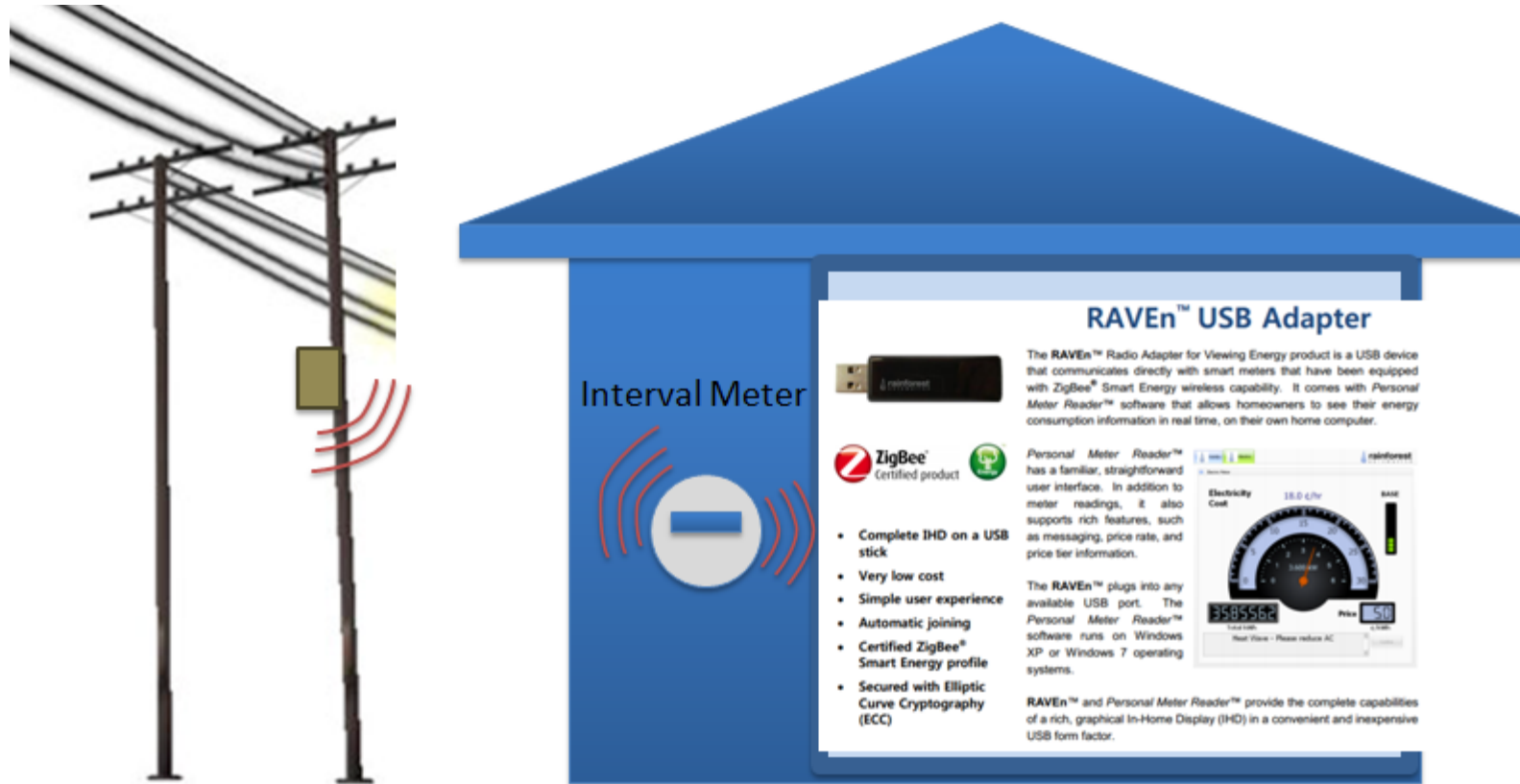
Project schedule

- Issue: want to show consumer benefit from interval meter data ASAP
 - Many manufacturers of display devices waiting for Zigbee Smart Energy Profile 2.0, citing problems with SEP 1.0 security.
 - But field tests happening now in Texas and elsewhere with SEP 1.x
 - Consumers not signing up for HAN pilots in large numbers
- LBNL is completing bench testing of OpenSEG now, and getting it ready to move out to interested consumers this summer
- Goal is field test in California during 2014 summer (several utilities) that uses:
 - data from interval meter directly
 - Utility-accepted meter-to-platform gateway
 - consumer-owned platformto measure robustness of HAN architecture, including smart meter reliability

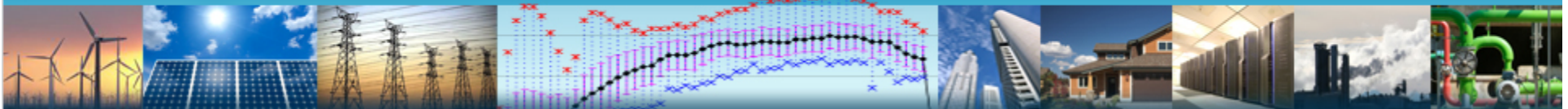
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It is possible now to get consumption data directly from the meter, but this exposes all Zigbee data clusters



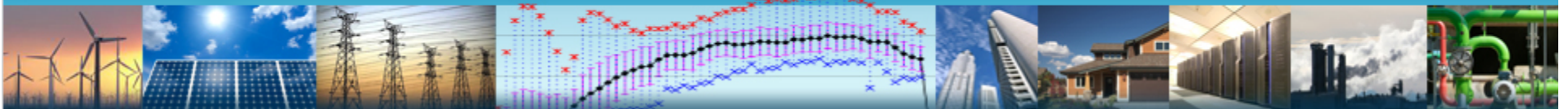
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Code foundation

- Proof of concept has been made at the benchtop level
- Now migrating to smaller, deployable platforms
- Testing to understand data storage and retrieval needs vs. available options (e.g., cloud vs device memory) AND overall reliability of system in the field

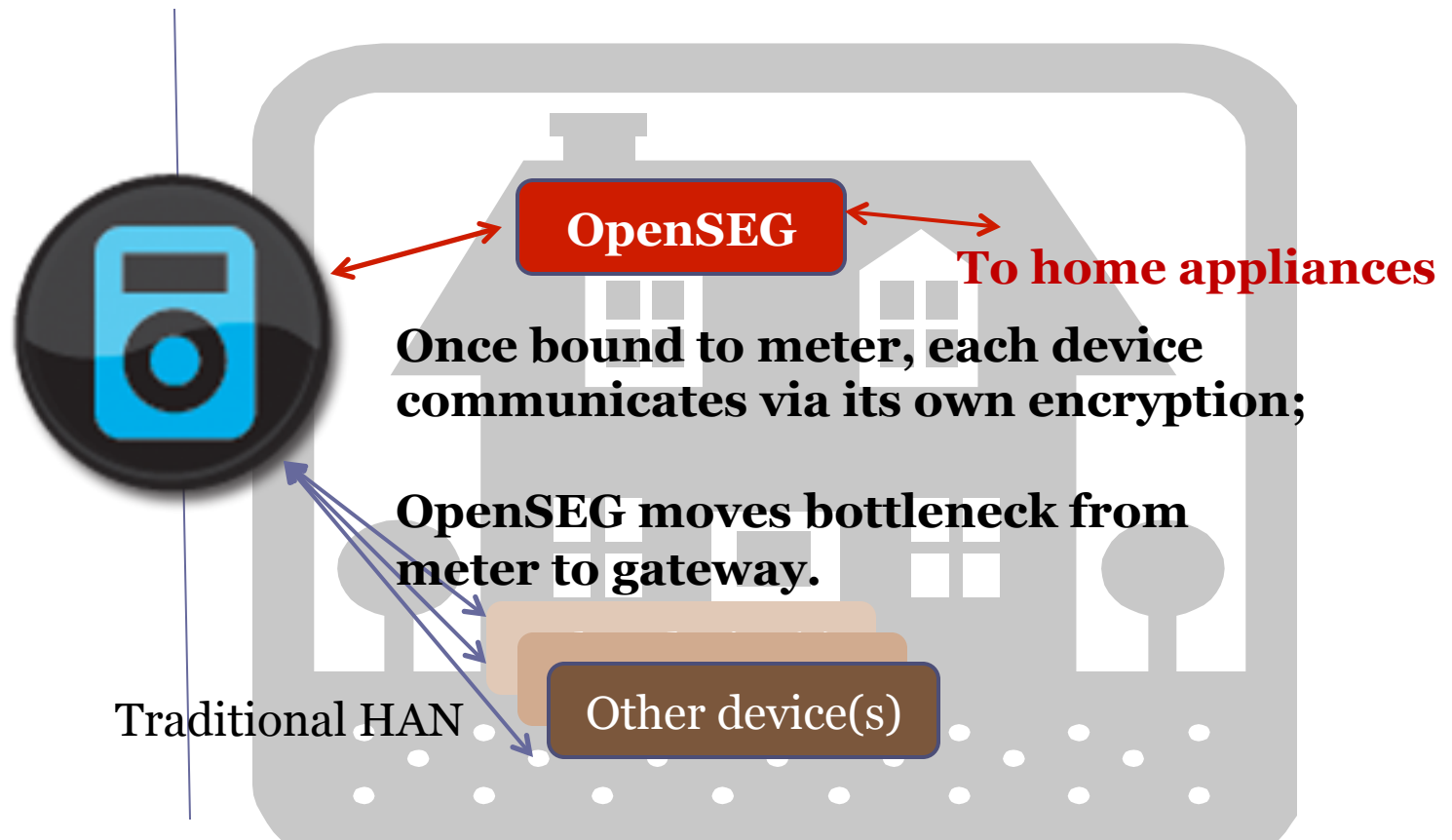
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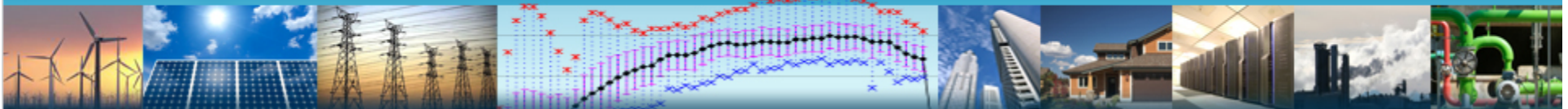
Topology of OpenSEG Architecture

AMI:

- Receives & processes revenue meter data
- Sends OK for certain devices to bind to this particular meter

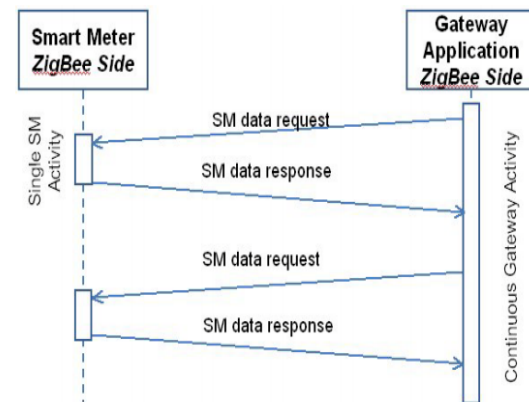


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Two step, secure data transfer from meter to application

- Restricts use of SEP 1.x message clusters to those clusters determined to be secure
- On application (consumer) side, gateway acts as a web server that can respond to properly formatted data requests arising from same network
- Data cache allows capability to synchronize and calibrate data with Green Button data
- Side benefit: allows meter data access to venues previously limited by Zigbee broadcast constraints (multifamily dwellings and larger homes) by using consumer's network



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